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Diversity of dragonflies (Odonata:insecta) in Ranchi, Jharkhand

Seema Keshari^{a*}, Jaya Kumari^b & M. Prasad^b

^aDepartment of Zoology, R.L.S.Y. College, Ranchi

^bDept. of Zoology, Ranchi University, Ranchi

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Abstract : Biodiversity conservation and management are worldwide concern. They play a vital role as prey and predator to maintain the balance of trophic levels for food chain. They are also an important and widespread component of freshwater ecosystems being the top predators. Dragonflies are potential biocontrol agents. In the present study an attempt has been made to know about the diversity and distribution of Odonates in Ranchi at different locations. All together seven species were recorded from various study sites and diversity richness has been determined by using Shannon Weiner index in different study zones

Key words : Dragonflies, , Diversity, Shanon- Weiner Index, Ranchi.

INTRODUCTION

Odonates are represented by dragonflies and damselflies. These are very conspicuous among the flying insects. They occur almost all over the world in varied ecological niches extending from the sea level to over 3,600 meter altitude and from brackish, marshy area to desert lands. These insects have strong flight power and eyesight (Lahiri, 1987).¹

Odonates spend a major part of their life cycle in fresh water ecosystem. The adults are generally predaceous insects, while the larvae are carnivorous and voracious. The species are usually highly specific to a habitat, some have adapted to urbanization and use man-made water bodies. Being primarily aquatic, their life history is closely related to specific aquatic habitats (Andrew et al. 2009)². They are biocontrol agents, many species of odonates inhabiting agro ecosystems play a crucial role controlling pest populations (Tiple et al. 2008)³

Odonates can fly backwards, move vertically like a helicopter or stop in turn in the midst of the most rapid

progression as if they have been remaining into it (Mitra, 1999)⁴. These insects characteristically have large rounded heads covered mostly by well-developed, compound eyes, legs that facilitate catching prey (other insects) in flight, two pairs of long, transparent wings that move independently, and elongated abdomen. They have three ocelli and short antennae. The mouthparts are on the underside of the head and include simple chewing mandibles in the adult (Hoell et al. 1998).⁵

Odonata are believed to be one of the ancient orders of insects. It first appeared during the Carboniferous era, about 250 million years ago along with mayflies (Subramanian, 2005).⁶ Odonata fauna of India is known by 3 sub orders, 17 families, 139 genera and 499 species and subspecies Prasad and Varshney (1995)*. Again Mitra (2005)⁷ recorded 499 species and later on 463 species were confirmed by Subramanian (2009)⁸ till date.

Fraser (1933-1936)^{9,10,11} published three volumes on Odonata in the 'Fauna of British India' including 536 species and subspecies of Odonata from India.

Study area

Ranchi, the capital of Jharkhand is located at 23°23' latitude and 82° 23' longitude. The study zone has been conveniently divided into four zones – East, North,

*Corresponding author :

Phone: 09835379406

E-mail :

West and South. These zones are further sub-divided into sectors for sight specific survey and sampling.

Climate

Climatic condition of Ranchi is moderate. Overall climatic condition of Ranchi varies from extreme cold during November to mid-February, then the Spring is followed by hot to very hot Summer from May to July, the Rainy season is from mid-July to about September.

(a) Temperature

The climate of this area is moderate. It fluctuates between 31.5^o to 39.6^o in summer sometimes even more and in winter it drops down to a minimum of 4.5^o to 18^o.

(b) Relative Humidity and Rainfall

The average rainfall in July-August is 251.4mm with proportional rise in relative humidity from 69.9 to 84.4 in August.

Methodology

Study Design

Study has been carried out from 1st July 2010 to 30th June 2011. For convenient of data collection the study area has been divided into four distinct zone based on different locations and directions etc.

Zone-I : East –South Area- Bariatu , Booty Area consists of Agricultural fields, pond area.

Zone-II:South-WestArea- Doranda, Hatia Area consists of Shrubs, large trees,Ponds.grasslands.

Zone-III:West-NorthArea- Pandra,Ratu Area consists of Wetlands, Ponds, Smallriver, Shrubs, Trees.

Zone-IV : North –East Area- Kanke, Pithoria consists of River,Pond,Agricultural area,SalForest

Data Collection and Analysis

Data was collected from four selected study zone with the help of butterfly net and by hand picking. The data were randomly collected in selected area as per methods used by Pollard et al.(1977)¹³ and Pollard (1975)¹². To collect the data the 24 hours of the day has been summarized and only hours of the day in the morning 0800hours to 1000 hours, midday 1200 hours to 1400 hours and afternoon 1600 to 1700 hours. The collected species were preserved after collection and kept in an insect box. After collection the species were stretched in a stretching box and pinning with the help of entomological pin. Nephthalene and Benzoic acid were used for the preservation. The species were identified with the help of

keys provided by Subramanian (2005)⁶ and Mitra (2005)⁷. Data are analyzed only with the help of Shannon Weiner Diversity index in different study zones.

a) Alpha (α) diversity Shannon Weiner index: -

$$\bar{H} = \sum p_i \log p_i$$

Where,

H = species diversity,

Pi = mean of individual species procured by the formula n/N,

logpi is the log product of pi (mean of individual species).

b Relative abundance = ni/N x 100

Where,

Ni = number of individuals of a species.

N = number of individuals of total number of species

c) Evenness = H/log2S

Where,

S = number of species, H= diversity.

(d) Rank abundance diagram similarity coefficient and dendrogram sketch through Jaccards similarity coefficient-

$$C_j = \frac{a}{(a+b+c)}$$

Where,

a= the number of species common to both sites taken.

b= the number of species in site, B, but not in A.

c= the number of species in site A, but not in B.

RESULTS

Overall species Compositions

Study revealed the presence of seven species of Dragonflies and Damsellies in four zones of Ranchi .Many species remained unidentified. The 16 Dragonfly species identified were *Aeshna* sps.,*Anax junius* .Drury,*Macromia magnifica*.Kennedy, *Lathrecista asiatica*.Fabricius, *Neurothemis tullia*. Drury, *Pantala flavescens* . Fabricius , *Potamarcha congener*.Rambur,*Ictinogomphus rapax*,(Common clubtail),*Acioma panoripoids*,(Trumpet tail),*Aethriamanta brevipennis*,(scarlet Marsh Hawk),*Crocothemis servilia*(Ruddy Marsh Skimmer), *Diplocodes trivialis*(Ground skimmer),*Orthetrum sabina*(Green Marsh Hawk), *Orthetrum traingulare* (Blue Tailed Forest

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Hawk), *Rhyothemis varigata* (Common Picture Wing) *Tamea basilaris* (Red Marsh Trotter). are found to be common in distribution in the study. Zone I and Zone III are rich in grassland, shrubs, water bodies due to all these characteristics Dragonflies and Damselflies are mostly found in these two study zones. Whereas in the Zone II water body is found less in number and in Zone IV shrubs, Trees, Ponds and rivers, Sal Forest, Agricultural land and grassland are also found.

Dragonflies: Check list of sampled species

Acioma panoripoids, (Trumpet tail),
Aethriamanta brevipennis, (scarlet Marsh Hawk),
Brachithemis contaminata (Fabricius)
Crocothemis servilia (Ruddy Marsh Skimmer),
Diplocodes trivialis (Ground skimmer),
Gynacantha *sps.*
Ictinogomphus rapax, (Common clubtail),
Macromia magnifica. Kennedy,
Neurothemis tullia. Drury ,
Orthetrum sabina (Green Marsh Hawk),
Orthetrum pruinpsum (Burmeister)
Pantala flavescens. Fabricius,
Potamarcha congener. Rambur,
Trithemis aurora (Burmeister)
Urothemis signata (Rambur)

Dragonflies prefers areas near waterbodies and is mostly found in the sunny morning. They spend their time in water and on land during their life cycles. Changes in aquatic plant communities reduce the quality of odonates habitat (Miller, 1987)¹⁴. Odonates play important role as both predators and prey. Being predators at both larval and adult stages, Odonates play significant role in the wetland ecosystem. Loss of Odonate species could have a bad effect on terrestrial and aquatic food webs. From the above discussion it is clear that for the distribution and diversity of Odonates in a suitable ecosystem containing waterbodies is very important.

Species Diversity Indices

Analysis of Shannon Winner Index of diversity shows that the species diversity was highest in Zone I (Bariatu

, Booty) and lowest in Zone III. In Zone II and Zone III the Jacards similarity co-efficient is somewhat equal as it is 0.9366 in Zone II (South –West Area- Doranda , Hatia Area) and 0.9306 in Zone III (West-North Area-Pandra, Ratu Area). The value of Dominance is highest in Zone IV (North –East Area ,Kanke, Pithoria) and lowest in Zone II.

Distribution and Abundance of Dragonfly Species

Analysis of proportional abundance of Dragonfly species shows that 14 species are collected was highest in Zone-I and lowest in Zone IV. Family Libellulidae is most commonly found in all the four zones.

DISCUSSION

The Order Odonata is an ideal model taxon for the investigation of the impact of environmental warming and climate change due to its tropical evolutionary history and adaptation to temperate climates (Hassall et al, 2008¹⁵, Neesemann et al, 2011)¹⁶. From the study it has been seen that distribution of different species are different in the 4 distinct zones. Their numbers vary in different zones. It has been seen that zone one has the maximum biodiversity. The zone I of Booty area consisted the agricultural area and ponds have maximum varieties of trees, grass fields and wetlands etc. Out of 15 species ,14 species are found in Zone I. 13 species were found in Zone III and Zone IV.

It has been found that *Brachithemis contaminata* , *Orethrum sabina* and *Orethrum pruinpsum* are most common in Zone I, while *Brachithemis contaminata* is most common in Zone III and *Orethrum sabina* and *Orethrum pruinpsum* is found least in Zone IV.

Variation in distribution is due to different environmental conditions. It depends upon the presence of wetland, grassland, shrubs, waterbodies, trees etc.

Odonates are important link between aquatic and terrestrial ecosystems. They play an important ecological role as both predators and prey. Thus their importance in ecosystem is very clear.

CONCLUSION

The present study highlights the presence of seven Damselfly species which can be considered to be an

Species	Zone-I						Zone-II							
	MV	pi	log pi	Relative abundance (RA = pi x 100)	S-W Alfa diversity H	Evenness E	Dominance D	MV	pi	log pi	Relative abundance (RA = pi x 100)	S-W Alfa diversity H	Evenness E	Dominance D
<i>Actinota panorpoides</i>	4	0.0310	-1.5085	3.1008	1.1106	0.9443	0.9158	2	0.02985	-1.5250	2.9851	1.10148	0.9366	0.9128
<i>Aethriamanta brevipennis</i>	8	0.0620	-1.2075	6.2016				4	0.05970	-1.2240	5.9701			
<i>Brachitkemis contaminata</i>	12	0.0930	-1.0314	9.3023				5	0.07463	-1.1271	7.4627			
<i>Crocothemis servilla</i>	0	0.0000	0.0000	0.0000				9	0.13433	-0.8718	13.4328			
<i>Diplocodus trivialis</i>	6	0.0465	-1.3324	4.6512				9	0.13433	-0.8718	13.4328			
<i>Gynacantha sfs.</i>	9	0.0698	-1.1563	6.9767				3	0.04478	-1.3490	4.4776			
<i>Ichinogomphus rapax</i>	11	0.0853	-1.0692	8.5271				5	0.07463	-1.1271	7.4627			
<i>Macromia magnifica</i> , Kennedy,	8	0.0620	-1.2075	6.2016				3	0.04478	-1.3490	4.4776			
<i>Neurothemis talita</i> , Drury,	5	0.0388	-1.4116	3.8760				3	0.04478	-1.3490	4.4776			
<i>Orthetrum Sabina</i> (G M Hawk),	20	0.1550	-0.8096	15.5039				3	0.04478	-1.3490	4.4776			
<i>Orthetrum prunosum</i>	13	0.1008	-0.9966	10.0775				5	0.07463	-1.1271	7.4627			
<i>Pantala flavescens</i> , Fabricius,	9	0.0698	-1.1563	6.9767				8	0.11940	-0.9230	11.9403			
<i>Potamarcha congener</i> Rambur,	8	0.0620	-1.2075	6.2016				5	0.07463	-1.1271	7.4627			
<i>Tribemis aurora</i>	6	0.0465	-1.3324	4.6512				3	0.04478	-1.3490	4.4776			
<i>Urothemis signata</i>	10	0.0775	-1.1106	7.7519				0	0.00000	0.0000	0.0000			
Species	Zone-III						Zone-IV							
<i>Actinota panorpoides</i>	2	0.0333	-1.4771	3.3333	1.0809	0.91840	0.91856	0	0.00000	0.0000	0	1.09449	0.9366	0.91632
<i>Aethriamanta brevipennis</i>	5	0.0833	-1.0792	8.3333				3	0.06818	-1.1663	6.8181			
<i>Brachitkemis contaminata</i>	3	0.0500	-1.3010	5.0000				4	0.09091	-1.0414	9.0909			
<i>Crocothemis servilla</i>	4	0.0666	-1.1761	6.6667				3	0.06818	-1.1663	6.8181			
<i>Diplocodus trivialis</i>	0	0.0000	0.0000	0.0000				5	0.11364	-0.9445	11.3636			
<i>Gynacantha sfs.</i>	7	0.1166	-0.9331	11.6667				5	0.11364	-0.9445	11.3636			
<i>Ichinogomphus rapax</i>	4	0.0666	-1.1761	6.6667				0	0.00000	0.0000	0			
<i>Macromia magnifica</i> , Kennedy,	3	0.0500	-1.3010	5.0000				2	0.04545	-1.3424	4.5454			
<i>Neurothemis talita</i> , Drury,	8	0.1333	-0.8751	13.3333				4	0.09091	-1.0414	9.0909			
<i>Orthetrum Sabina</i> (G M Hawk),	5	0.0833	-1.0792	8.3333				4	0.09091	-1.0414	9.0909			
<i>Orthetrum prunosum</i>	8	0.1333	-0.8751	13.3333				2	0.04545	-1.3424	4.5454			
<i>Pantala flavescens</i>	3	0.0500	-1.3010	5.0000				4	0.09091	-1.0414	9.0909			
<i>Potamarcha congener</i> Rambur,	4	0.0666	-1.1761	6.6667				3	0.06818	-1.1663	6.8181			
<i>Tribemis aurora</i> ,	4	0.0666	-1.1761	6.6667				3	0.06818	-1.1663	6.8181			
<i>Urothemis signata</i>	0	0.0000	0.0000	0.0000				2	0.04545	-1.3424	4.5454			

Table 1 : Sampling data and Statistical information indices (S-W alpha diversity- H, Relative abundance -RA, Dominance-D and Evenness-E) of dragonflies population sampled from all the four Zones of Ranchi, Jharkhand .

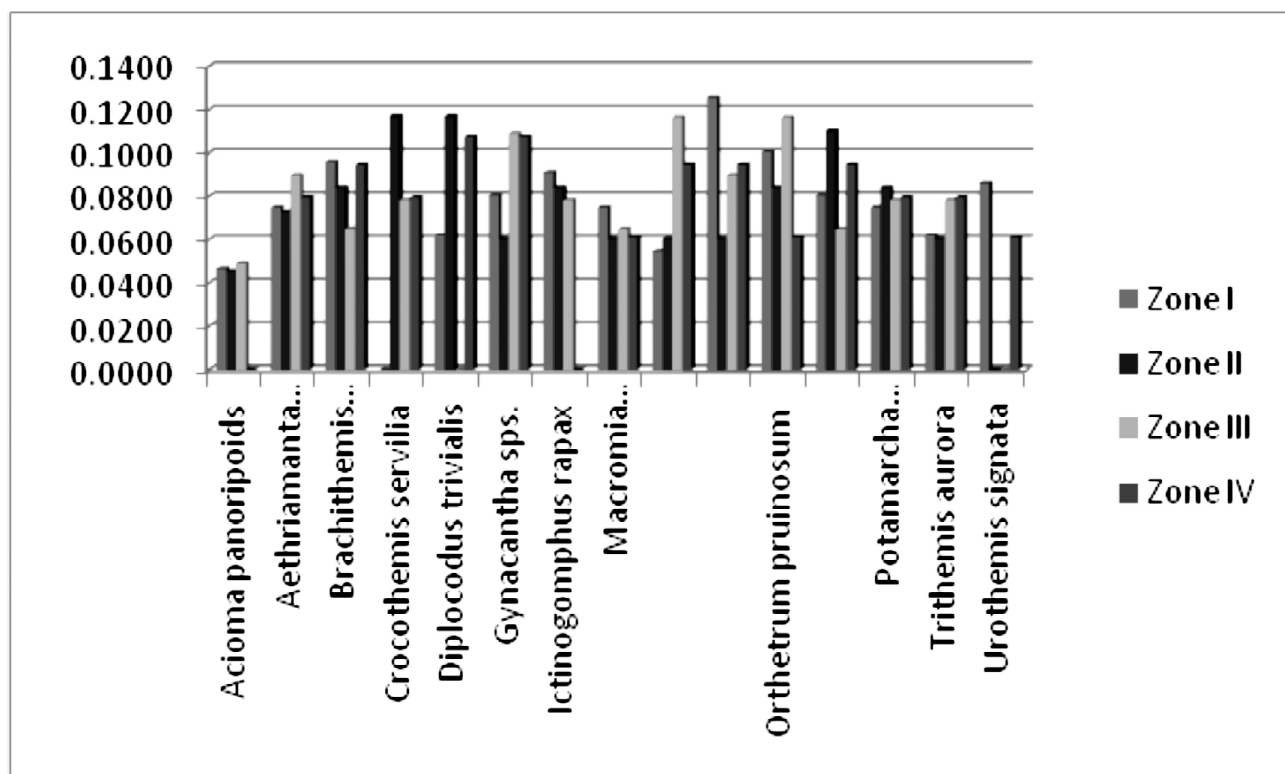


Fig-1: Graph of Species diversity of dragon flies sampled from four zones of Ranchi, Jharkhand.

important finding. Rapid urbanization and other factors like shrinking of marshy land, vegetation cover etc. may have contributed to biodiversity sinking of Odonates.

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